MANUAL

FOR

Borough and Township High Schools

OF

Pennsylvania

ISSUED BY

The Department of Public Instruction,

1909.

HARRISBURG, PA.:
HARRISBURG PUBLISHING CO., STATE PRINTER.
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INTRODUCTION

In response to a general demand by teachers, principals, and superintendents, as expressed in resolutions at educational meetings, this manual has been prepared.

The minimum requirements for admission to high schools do not constitute a course of study for elementary schools. They are intended to aid the teachers in the selection of the essentials of instruction, and to unify the work of the grades and the work of the high school.

The outlines of high school studies are designed to aid teachers and directors in their efforts to make the high schools efficient. These outlines have been planned on the assumption that the school year consists of at least nine months. Teachers and pupils are not expected to accomplish in seven or eight months, what is here outlined for a school year.

City high schools can of course attempt more than is here outlined, and each community can make additions suited to its special needs and industries.

LEGISLATION AND APPROPRIATIONS.

The last legislature appropriated one hundred thousand dollars to aid in the payment of the high school tuition of non-resident pupils, and four hundred fifty thousand dollars to support and encourage township and borough high schools. High schools in independent districts as well as joint high schools will hereafter receive a share of the appropriation in aid of township and borough high schools.

Under the last General Appropriation Act no district can participate in this appropriation if its high school has an attendance of fewer than twelve pupils. Pupils who have not completed the studies of the grammar school (usually known as the seventh and eighth grades) can not be counted as high school pupils.

Pupils residing in a district which maintains no high school, can attend the nearest or most convenient township or borough high school at the expense of their district, and in order to lessen the burden of this expense and to strengthen the high schools already established, the legislature set apart the sum of one hundred thousand dollars to aid in paying the tuition of non-resident pupils. Judge Bouton recently gave an opinion that non-resident pupils applying for admission to a high school must be examined by the principal of that high school under the direction of the County Superintendent, and admitted by the vote of the Board of Directors in charge of said high school, their action being duly recorded on the minutes, otherwise the district in which the pupil resides, is not liable for payment of tuition. Furthermore a township or borough is not liable for the tuition of its pupils who attend a city high school. It is hoped that this defect in the law may be remedied by future legislation.

No high school can hereafter receive appropriation as a high school of the first grade unless it has at least three teachers who devote their entire time to high school work during a period of nine months, and no high school can receive appropriation as a high school of the second grade unless it has two teachers who devote their entire time to high school work during a period of eight months.

The law governing the qualifications of teachers has not been changed. The Act of 1895 says that the directors of every district receiving aid for its high school "shall employ at least one teacher legally certified to teach bookkeeping, civics, general history, algebra, trigonometry, including plane surveying, rhetoric, English literature, Latin, including Caesar, Virgil and Cicero, and the elements of physics, chemistry, including chemistry of soils, botany, geology, and zoology, including entomology, and no teacher shall be employed to teach any branch or branches of learning other than those enumerated in his or her certificate." Entomology is included under zoology and need not be specially enumerated in the certificate. The same is true of the chemistry of soils which is included under the general subject of chemistry.

The possession of a normal school or college certificate does not prove that the holder has the qualifications enumerated in the Act of 1895. Directors should compare the applicant's certificate with the enumeration of branches required by law. The County Superin-

tendent can issue a provisional certificate for branches not named on the normal or college certificate, but this should be done only on the basis of an examination and should not degenerate into a mere device to obey the letter of the law while violating its spirit and manifest intention.

The classification of high schools is based upon the work actually accomplished and not upon the printed course of study. In cases of doubt the high school inspector may visit a high school several times to ascertain the facts. It is the law in some states and the custom in all to classify high schools on the basis of the shortest course from which they graduate pupils. This is necessary to comply with the requirements of Entrance Examination Boards which give credit for work indicated by high school certificates or diplomas.

An amendment to the medical act raises the standard of preliminary education to a four year high school course or its equivalent. Whilst for a large proportion of the pupils the high school is a finishing school, it should so far as possible aim also to be a fitting school for those who wish to enter a professional school, or a technical school, or a college.

On the other hand the high school should not aim to do the work which properly belongs to the normal school. The last legislature appropriated a total of $747,000 to pay at normal schools and city training schools the tuition of persons preparing to teach, and it should not be expected that township and borough high schools duplicate the work of these professional schools.

Reviews of the common branches designed to prepare for teachers' examinations or for advanced classes in the normal school, should not be considered the legitimate function of township and borough schools, because such reviews interfere with the instruction needed by that great majority of pupils for whom the high school must be the finishing school.

MINIMUM REQUIREMENTS FOR ADMISSION TO HIGH SCHOOL.

ENGLISH.

GRAMMAR.

I. Pupils should have well defined notions about each of the following: Language, inflection, conjugation, declension, comparison, gender, person, case, number and voice.

II. Knowledge of the pronouns and ability to use them.

III. Knowledge of the sentence:—(1) Subject, (2) predicate, (3) classification according to use, (declarative, imperative, interrogatory and exclamatory, (4) according to form (simple, complex and compound), (5) ability to recognize and write each correctly.

IV. Clauses:—Ability to discriminate between independent and dependent clauses. Drill in analysis of easy sentences.

V. Sufficient acquaintance with parts of speech to be able to recognize the use of the words in the sentence remembering that the use determines the part of speech to which it belongs.

VI. Drill on verbs according to use:—transitive, intransitive and copulative; according to form:—regular and irregular: and conjugation of same in all the tense forms. Drill in the use of the infinitive and participle.

VII. Knowledge of syntax.

VIII. Ability to compose letters of good form:—(a) friendship, (b) invitations, acceptance and regrets, (c) business forms, (d) application for a position.

IX. Practice in writing to train pupils to express clearly and connectedly what they have gained by experience, or what they have learned by reading.

X. Knowledge of the paragraph (only as divisions on the page), quotation marks, punctuation marks, use of capitals, and reproduction. A study of a few model compositions for forms of expression and outline.

XI. Ability to spell correctly all the words in common use. Pupils should early form the habit of consulting the dictionary. Their vocabularies may be strengthened and increased by daily study of new words. These words should be used in original sentences. They may be taken from literature read, or other sources. The work in English will be much improved by such study.

XII. Picture study may be used as a valuable aid in elementary English. Copies of the great masterpieces are easily obtained, and have not only a value as material for composition work, but are more important for their aesthetic influence.

SELECTIONS SUITABLE FOR MEMORY WORK IN GRADES VI, VII AND VIII.

Lincoln.—Address at Gettysburg.
Longfellow.—Psalm of Life, The Builders, The Ship of State, The Arrow and the Song, Excelsior.
Tennyson.—Charge of the Light Brigade, The Brook, The Bugle Song.
Bryant.—To a Waterfowl, Thanatopsis.
Whittier.—The Barefoot Boy.
Finch.—The Blue and the Gray.
Holmes.—The Chambered Nautilus, Old Ironsides.
Leigh Hunt.—Abou Ben Adhem.
Sam. Foss.—House by the Side of the Road.
Read.—Sheridan's Ride, Drifting.
Drake.—The American Flag.
Wordsworth.—The Daffodills.
Howe.—Battle Hymn of the Republic.
Shelley.—To a Skylark.

BOOKS FOR READING AND STUDY IN GRADES VI, VII AND VIII.

Longfellow.—Hiawatha, Courtship of Miles Standish.
Irving.—Legend of Sleepy Hollow, Rip Van Winkle.
Browning—Pied Piper of Hamelin.
Dicken's Christmas Carol.
Hawthorne.—Tanglewood Tales.
Whittier.—Snowbound.
Ruskin.—King of the Golden River.
Stowe.—Uncle Tom's Cabin.
Cooper.—Leatherstocking Tales.
Carroll.—Alice in Wonderland.
Defoe.—Robinson Crusoe.
Arnold.—Sohrab and Rustum.
Perry.—Odyssey.
Kipling.—Captain Courageous.
Lamb.—Adventures of Ulysses.
Chapin.—Story of the Rhinegold.
Pyle.—Story of King Arthur and his Knights.
Wiggin.—The Birds' Christmas Carol.
Page.—Santa Claus' Partner.
Scott.—Talisman.

Familiarity with a large number of the preceding books and poems is an essential part of any liberal education in the elementary school. To store the mind with the exact words of the authors who have given us their best thought in beautiful form is far better than to commit useless mathematical formulas or technical definitions in any subject.

Several of the selections to be memorized should be chosen in each of the last three years of the course. A specific and somewhat accurate knowledge of three or four classics and a familiarity with eight or ten others, will give a broad foundation for High School English.

ARITHMETIC.

In this study pupils should be accurate and have acquired considerable speed in the use of:—

(a) The four fundamentals.

(b) Simple fractions: Addition, subtraction, multiplication and division.

(c) Decimals: Writing, reading, addition, subtraction, multiplication and division.

(d) Denominate numbers:—

1. Tables in use:
   - U. S. Money.
   - Avordupois Weight.
   - Dry Measure.
   - Liquid Measure.
   - Square Measure.
   - Linear Measure.
   - Cubic Measure.
   - Time Measure.
2. Reduction. Simple cases of ascending and descending.
3. Practical measurements.
4. Standard time (with geography).

(e) Principles of percentage with practical questions in profit and loss, insurance, taxes, commercial discounts, commission and brokerage, and simple interest (one method only), omitting questions in which time and principal are to be found.

(f) Negotiable paper and other business forms, as making out bills and keeping accounts (not formal bookkeeping).

(g) Ratio and simple proportion.

(h) Square root of small numbers, including integers, fractions, and decimals.

(i) Mensuration of surfaces.

GEOGRAPHY.

Pupils should be thoroughly informed about North America in the following:—

1. Latitude and longitude. Seasons. Zones.

2. Countries, United States, Canada, Mexico, Central America and Panama.

3. Physical features. Mountain systems, river systems, water sheds, lakes, peninsulas, gulfs and bays, straits and islands.

4. Climate. Influence of elevation, removal of forests, nearness to the sea, prevailing winds, ocean currents, weather reports.

5. The United States with fuller detail.
   1. Groups of States:—
      (a) North Atlantic.
      (b) South Atlantic.
      (c) South Central.
      (d) North Central.
      (e) Western States.

   2. (a) Location of States in each group with reference to the United States as a whole and the other countries of North America. Surface, climate, important rivers. Map drawing from memory.
      (b) Resources. Soil, forests, mineral and oil deposits, fisheries.
      (c) Industries and products. Agriculture, grazing, lumbering, mining, fishing, leading manufacturing, mechanical, professional and commercial pursuits.

   3. Interstate travel and transportation. Trunk railroads. Steamship by lakes, by ocean. River navigation. Artificial irrigation. Immigration.

   4. Cities.—Location of one or two important cities in each of the leading States of the Union. Pupils should know from 50 to 100 important cities of North America.

   5. Dependencies. Names, location, climate, important cities, people, industries and products. Advantages to the United States.

   6. Pennsylvania should receive fuller treatment;—physical features, products, industries, people of the different sections of the State, areas in which farming, mining, oil, coal, soft and anthracite, predominates, relative position of

counties, educational institutions, places of historical interest, noted statesmen, scholars and poets, and chief centers of population.

7. South America and Europe should be studied in a manner similar to that of North America with less detail, giving considerable attention to relative position and comparative size of countries, physical features, commercial and manufacturing centers, chief industries, natural resources, trade routes, important cities and rank of countries in civilization.

8. Asia, Africa, Australia and island groups should receive one full treatment. The success of this work will depend on how well the pupils have grasped the salient points and how thoroughly the details have been centered about these points.

PHYSIOLOGY.

The essentials in physiology may be grouped under the following topics:—

1. The Skeleton.
   The use of bones, of cartilage, adaptation of bones to their use. Why most bones are hollow. Why skeleton is composed of many bones. Ligaments, tendons, vertebrae, joints. How bones of children differ from those of adults. How broken bones heal; why they must be set; use of splints. Composition of bones.

2. Muscles.
   Kinds and uses. Contraction the chief characteristic. How controlled. Voluntary and involuntary. Tendons and their use. Results if tendons were elastic. Exercise a developer of muscle. Alcohol and fatty degeneration of the muscles. Effects of alcohol and tobacco on the heart.

3. The Skin.
   Structure and layers. Use. Perspiration. Sensible. Insensible. Quality. Pores. Hair. Nails. Use.
   Bathing. Time, frequency, necessity.
   Care of hair and nails.
   Cleanliness.

4. Food.

Need of food and drink. Why the body is warm. Temperature of body. Effect of starvation on the muscles. Fat as a reserve. What foods must contain. Advantages of variety. Use of cooking. Assimilation. Effects of over-eating, of working immediately after eating, of retiring after eating heartily. Time required for digestion. Alcohol as a food.

5. Digestion.

Mouth, teeth, tongue, salivary glands, gullet, stomach, gastric glands, intestines, liver and pancreas and their functions. Objects of digestion. Use of the various digestive juices. Chyme and chyle. Lacteals and other absorbents. Appetite. Care of teeth. Diseases of digestive organs. Time to eat. Quantity of food necessary. Digestion influenced by severe physical or mental strain. Alcohol and tobacco in relation to digestion.

6. Circulation.

Need of blood and its composition. Coagulation. Organs of circulation. Arterial and venous blood. Pulse. How heart rests. Valves. Why no valves in arteries, no pulse in veins. How to stop bleeding of arteries. Effect of alcohol on circulation. Blood, heat of body.

7. Respiration.

Organs. Object of breathing. Respiratory movements, removal of air in lungs. Amount breathed daily. Diaphragm. Changes in air and blood in lungs. Ventilation and its necessity. Effect of tight clothes. Influence of tobacco and cigarettes in youth. Alcohol on breath. Simple experiments with candle to show use of oxygen.

8. Nervous system.

Nerve centres and nerve fibres. Compare with electric circuit. Brain and spinal cord. Cranial and spinal nerves. Pairs of sensory and motor nerves. Sympathetic nervous system. Use of pain. Reflex action. How repetition forms habit. Safe way to avoid bad habits. Effects of alcohol on nerves, brain and will power.

9. Special senses.

Organs of each. How image is formed on retina. Short sight and long sight. How corrected by lenses. Care of eyes and ears. Where touch is most sensitive. Use of taste.

10. Voice and Speech.

Organs and functions. Vocal cords. How voice is produced. Pitch and modulation. Speech. Effect of alcohol upon speech and upon these organs.

HISTORY.

Pupils should be familiar with the following topics in American History.

1. Causes leading up to the discoveries in the new world.

2. The discoveries made by the different European countries with geography.

3. The Colonial period with special reference to the early history of Virginia, New York, Massachusetts and Pennsylvania. Also causes of emigration, character of settlers, geographical situation of each colony, with climate and physical features, and a study of a dozen or more persons who took a prominent part in the settlements.

4. Indian troubles.

5. The French explorations and their attempt to control the Ohio River.

6. The French and Indian War. The effects of the war.

7. Memorizing twelve dates with the events they represent between 1607 and 1763, the end of the French and Indian War.

8. The Revolutionary Period. Causes of the Revolution (a) general, (b) as enumerated in the Declaration of Independence. A half dozen statesmen of this period. Several chief events. Results of the war.

9. The critical period of 1783-1789. Commercial disputes, boundary conflicts, western territory. Ordinance of 1787. Constitution adopted. Articles of Confederation.

10. Explorations and acquisition of territory. The Louisiana Purchase. Lewis and Clark. Industries.

11. War of 1812. Causes, results, commercial independence.

12. Perhaps a dozen dates and events should be committed to memory, 1765-1815.

13. 1815-1860. National growth. North West territory. Acquisition of Florida. Admission of Texas. Mexican War. Acquisition of California. Great inventions. Tariff and revenue explained. The slavery question. Missouri Compromise; Compromise of 1850; Kansas and Nebraska Bill; John Brown; election of Lincoln.

14. 1860-1870. Civil War and reconstruction; Secession; On to Richmond; Coast blockade; Appomattox; Constitutional Amendments. Purchase of Alaska; Alabama claim.

15. 1870-1909. Industrial growth. Immigration. Spanish-American War. Peace Movement; Panama Canal. Reciprocity. About twelve dates with events between 1819 and 1909. Roosevelt and the Treaty of Portsmouth.

At least two years of nine months each should be required to do this work. Grades 6 and 7 or 7 and 8 should be used.

DRAWING.

As a form of expression, the importance of drawing cannot be over-looked. Its value in life and in many of the studies in higher institutions, as well as in the high school, makes it imperative that pupils in the elementary schools should receive as much training in this art as their teachers can give. Neighboring districts may unite in securing the services of a specialist in order that this work may be done most effectively.

VOCAL MUSIC.

Every pupil in the public schools should know the rudiments of music, and be able to read songs at sight. Many choice songs including our national hymns should be committed.

WRITING.

Pupils should be able to write legibly some good system of writing. Habits are formed in the grades that will aid or hinder the work of the high school. Ordinary rules regarding the form of a manuscript and for punctuation and capitalization should be mastered before entering the high school.

OUTLINES OF HIGH SCHOOL STUDIES.

ENGLISH.

The general aim of English in the high schools is to give pupils first an acquaintance with, and appreciation of, the best literature, and secondly a training in expression of their own ideas in speech and writing.

By common consent English claims first place in both the elementary and the high school curriculum. The Committee of Ten is of the opinion that the study of English should be pursued in the high school for five hours a week during the course of four years. It recommends the assignment of three hours a week for four years to the study of literature and the assignment of two hours a week for the first two years, and one hour a week for the last two years to training in composition. By the study of literature is meant the study of the works of good authors, not the study of a manual of literary history.

First Year.

The reading during this year should be for pleasure and appreciation. Let it be rapid. Pupils like things to happen. Too much detail in analysis, study of words, and rhetorical features, becomes too tedious and destroys interest. Attention should be given to the main points, such as the plot, the background, the characters and the personality of the author. Pupils should read aloud both at school and at home. It is a good plan for the teacher to read to the pupils. This kind of reading gives a basis for class discussion. Pupils should be held responsible for the salient points, together with such details as are necessary to connect the story. Pupils should be required to tell what is beautiful, what is forceful. Elegant passages may be committed to memory. These should be reviewed frequently.

In the reading of the first year, group the American authors studied, with other important writers, according to periods; Colonial, Revolutionary, National, or Geographically; Anti-Slavery group, New York writers, Cambridge poets and Southern writers. No text book is necessary for this instruction. Something of the author, his early life, education, time in which he wrote and rank as an author, should be made a part of the study of a classic.

For composition and rhetoric in the first year the following outline is suggested:

1. The sentence with special attention to structure, placing of modifiers for clearness and emphasis, and careful use of connectives.
   - I. a. Single.
     b. Complex.
     c. Compound.
   - II. a. Loose.
     b. Periodic.
2. Composition.
   1. Subjects: general limited.
   2. The Paragraph, the unit of discourse.
   3. Parts of: (1) Introduction, (2) discussion, (3) conclusion, with careful attention to transition from part to part.
3. Kinds of writing and order in which they are to be taught. (1) Narration, (2) description, (3) exposition as suggested in (f) under 6.
4. Diction, value of specific words, synonyms, etc.
5. Figures of speech.
6. Material for oral and written work.
   a. Topics read (1) by pupil (2) by teacher.
   b. Topics within the experience of the pupils.
   c. Letters of all kinds.
   d. Pictures, accidents and incidents.
   e. Reviews or reports of books and articles.
   f. Explanation of games (how to play them, exposition). Report of games (narration and description)

Second Year.

The reading in this year should be done in a manner similar to that of the first, with fuller detail and more discussion, including some study of the author, period in which he lived, and a grouping of authors into important periods. In this year pupils should be made familiar with our best periodical literature, such as Harper's, Scribner's, Century, Atlantic Monthly, and magazines or reviews of like grade and worth.

The composition work of each succeeding year should enlarge upon the principles of writing. The paragraph, the unit of discourse, should receive fuller treatment than in the preceding grade. All forms of composition should be practiced,—narration, descrip-

tion, exposition and argument. This will give pupils an opportunity to find themselves. In this year greater accuracy and force in expression is urged. Give opportunities for reports of adventures, accidents and attendance at games. Require written opinions of books and articles. Have them briefly and frankly told.

Third and Fourth Years.

During the last two years in reading the master pieces, the work should be more critical. Together with the plot, the style of the author and historical setting, give the pupils an intelligent interest in some of the literary types, such as the romantic novel, tragedy and comedy, narrative poetry, didactic poetry, epic and lyric verse. Give attention to geographical, historical, Biblical, literary, and mythological allusions. All these are necessary to a proper interpretation of literary works. Give careful study to the lives of authors, periods in which they lived and wrote, what motive prompted them to write, and influence of each. Also study the important periods in English literature with a view of getting the relation of the same to the historical movement in civilization.

The composition work of the third and fourth years should include practice in all forms of writing of the first and second years. The subjects should be selected from many sources, such as class readings, summaries of debates, character sketches, critical opinions of books, and some encouragement might be given to writing verse.

During the last year the important parts of Rhetoric may be studied in greater detail and those omitted in the first year taken up. At least one composition a week should be required. These should show completeness of form, unity, good diction, coherence, strength and clearness. The criticism, however, must not discourage free expression.

READING AND STUDY.

FIRST YEAR.

Irving.—Sketch Book.
Longfellow.—Evangeline.
Hawthorne.—Twice Told Tales. The Gray Champion.
Cooper.—The Last of the Mohicans.
Franklin.—Autobiography.
Bryant.—Thanatopsis.
Whittier.—Snow Bound.

If any of the above have been read in the grades, the following may be substituted:

Irving.—Tales of a Traveler.
Scott.—Ivanhoe.
Tennyson.—The Brook.
Lanier.—The Brook.
Dickens.—Tale of Two Cities.
Palmer.—Odyssey.
Shakespeare.—As You Like It.

Second Year.

Lowell.—Vision of Sir Launfal.
Coleridge.—Ancient Mariner.
Lamb.—Essays of Elia.
Eliot.—Silas Marner.
Poe.—Gold Bug.
Shakespeare.—Merchant of Venice.
or
Gaskell.—Cranford.
Stevenson.—Inland Voyage.

Third Year.

Tennyson.—Idylls of the King—Lancelot and Elaine
The Coming of Arthur
Passing of Arthur
Holy Grail.
Shakespeare.—Julius Caesar.
Addison & Steele.—Sir Roger de Coverly Papers.
Macaulay.—Life of Johnson.
Webster.—Reply to Hayne.
Chaucer.—Prologue.
Carlyle.—Essay on Burns.
Irving.—Life of Goldsmith.

Fourth Year.

Burke.—Speech on Conciliation.
Browning.—How They Brought the Good News.
Evelyn Hope.
Herve Riel.
Emerson.—Essays on Compensation, Self Reliance.
Milton.—L'Allegro, Il Pensoroso, and Comus.
Shakespeare.—Macbeth.

Note. It is urged that other books besides the ones suggested be read.

Selections Suitable for Memory Work.

Bryant.—Thanatopsis.
Longfellow.—Psalm of Life.
Holmes.—The Last Leaf.
Emerson.—Concord Hymn. Each and All.
Lowell.—Commemoration Ode.
Lincoln.—Gettysburg Speech.
Kipling.—Recessional.
Parts of—Merchant of Venice.
Ancient Mariner.
L'Allegro.
Il Pensoroso and other gems of thought.

Books every teacher of English should have.

1. Report of Committee of Ten.
2. Chubb. Teaching of English in the elementary and secondary schools.
3. Carpenter, Baker & Scott, Teaching of English.
4. Heydrick—How to Study Literature.
5. McMurry—Special Method in the Reading of English Classics.—Macmillan.
6. Monographs on English.—D. C. Heath & Co.

MATHEMATICS.

The importance of a mathematical course throughout the secondary school is unquestioned. Its fine training in accurate thinking, its inexorable demand for exact results, and its attack of difficulties that must disappear before the resources of the earnest pupil, render the study of mathematics most valuable.

The teacher must avoid making the work merely formal or mechanical. The subjects may be made concrete and real by bringing them close to the life and interests of the pupil. New ideas must be presented clearly and definitely. The distinction between what is known and what is unknown, what is given and what is to be found, is fundamental.

The recitation should be so conducted that a maximum of work is accomplished by every pupil. Tedious explanations of what is already understood by the class, are worse than useless.

Power to think rather than the ability to memorize, is the great goal of the course.

FIRST YEAR ALGEBRA.

In the last year of the grammar school, some algebra may be introduced in connection with arithmetic. Thus pupils become familiar with algebraic terms and language. The practice of the best schools agrees with the recommendation of the Committee of Ten, that the study of formal algebra should begin when the pupils are 14 years of age, in the first high school year.

The work of this first year (of 9 months) should include:—

1. Definitions and notation.
2. Fundamental operations.
3. Simple equations not involving algebraic fractions, with many problems.
4. Factoring.
5. H. C. D. and L. C. M. (factoring method).
6. Fractions including ratio and simple proportion.
7. Simple equations in one, two, and three quantities, with attention to graphs of equations in two quantities.
8. Involution and evolution with positive integral exponents.

SECOND YEAR ALGEBRA.

1. Review of the essentials in preceding year's work.
2. Simultaneous equations.
3. Square root; cube root; radicals; imaginaries.
4. Quadratic equations.
5. Radical equations.
6. Theory of exponents.
7. Binomial theorem.
8. Practical problems.

Notes. Frequent reviews are essential. In teaching equations in first year do not emphasize "transposition" and "clearing of fractions" but let the appeal be to fundamental processes. In simultaneous equations, the "addition-subtraction" method of elimination should prevail, though the others should be understood. In quadratics, teach thoroughly one method of completing the square. In many problems the best one is that which calls for dividing by the coefficient of x^2. Also teach the methods of solution by factoring, and by use of the formula. This course omits series, progressions, and logarithms. It may be possible for the long term schools to complete this work in a year and a half but the 7 and 8 month term schools should attempt nothing more in mathematics in the first two years.

THIRD YEAR, PLANE GEOMETRY.

This subject may be completed in nine months. Time may be gained by going very slowly in the first book. If time permits all the original exercises of the first book and selections from the others should accompany the work. Accurate construction work both at the board and on paper should be required. Written demonstrations at the board are of very doubtful value. Figures are all that are necessary at the board. Insist upon accurate expressions in all demonstrations. Great care must be taken to avoid making the study of Geometry a memory exercise.

FOURTH YEAR, SOLID GEOMETRY AND PLANE TRIGONOMETRY OR MENSURATION.

For the study of solid Geometry, the pupil should construct the models from card board. Great emphasis should be laid upon its practical features, and if a special course in Mensuration does not follow it, then many numerical problems should be given.

The subject may be completed in five months and if the school contains many boys, or if it prepares many students for college, then Plane Trigonometry may follow for the remainder of the year. In this subject there is motive for the study of logarithms and they should be given when needed. If there is no call for Trigonometry then Mensuration and some other arithmetical subjects may be studied to complete the year.

MATHEMATICAL BOOKS FOR TEACHERS.

Ball.—Short History of Mathematics. Macmillan Co.

Smith.—The Teaching of Elementary Mathematics. Macmillan Co.

Clifford.—Common Sense of the Exact Sciences. Appleton.

Langley.—Computations. Longmans.

Chrystal.—Algebra 2 vols. Macmillan Co.

McMurry. Special Method in Arithmetic. Macmillan Co.

School Science and Mathematics. Monthly.

DRAWING.

Drawing is considered by many prominent educators to be one of the most valuable subjects taught. There is no doubt in the coming years drawing will receive greater attention in the public schools.

The fact that so few elementary schools teach this study, makes it difficult to accomplish much in high schools with a two years' course. The work, however, should be started and carried on through the entire course whatever its length may be.

The work at first will require instruction in the use and handling of materials, such as, pencil, crayon, brush, dividers, ruler, paper and T square. The scope of the work for a four years' course should comprise studies in nature, such as, simple landscapes, leaves, trees and flowers; in constructive drawings, of boxes, book cases, book racks, and wall cabinets; in free-hand drawings of many objects with large expression to develop perspective; considerable practice in lettering, and mechanical drawings of parts of machines, such as levers, cams, cranks, pulleys and wheels. Together with this training pupils should receive instruction in light and shade, principles of perspective and arrangement, composition, color design, symmetry, unity, contrast, strength, proportion, balance, harmony and repose.

BOOKS ON MECHANICAL DRAWING AND ART.

Cross' Light and Shade. Ginn & Co.

Mechanical Drawing. Ginn & Co.

Miller's Essentials of Perspective. Scribner.

Hoyt's World's Painters and their Pictures. Ginn & Co.

Emery's How to Enjoy Pictures: with a chapter on Pictures in the school room. Prang Educational Co.

Redgrave's Manual of Design. Scribner.

VanDyke's How to Judge a Picture. Easton & Mains, N. Y.

Parkhurst's Sketching from Nature. Orange, N. J.

HISTORY.

The educative value of historical study properly gives it a place among the subjects to be taught in the high school. In Professor Horne's Philosophy of Education we read, "The human mind is trained to judge through the interpretation of the facts of history, supported by the memory and questioned by the imagination. It has a practical value in fitting youth for citizenship in a self-governing country. The practical element in the social environment is a great moral teacher of the pupil."

Perhaps the most generally accepted order in which to teach the different fields of history is that suggested by the Committee of Seven; Ancient, Mediaeval and Modern, English, and American.

This is the logical order since it begins with the past and leads step by step to the present. Because of the simple forms of government and primitive life of the ancient peoples, it seems to be the natural order to present to the mind during the first year of the high school, while the complex institutional life of England and the intricate problems of America should be retained for the last years of the course. Success in teaching history will in a large measure, depend on a careful selection of history material. This makes it necessary to eliminate much that is found in our text books. Teachers must be willing to omit entirely or treat briefly, long accounts of wars, details of many battles, reports of dynasties, and unimportant facts of history. Attention should be given to the selection, arrangement and organization of the material.

The Committee of Seven recommends that history should be taught through the entire course, for three periods a week. It is especially to be noted that each field of history should be studied through the entire year. Time is an important factor, in tracing relations, fixing facts in the memory, and covering the amount of reading necessary for proper historical study. In regard to method it seems entirely proper to make a suggestion. A suitable text book on history should be used as a guide rather than as a source of all the information. The method should be in the main topical. Large topics or questions should be selected and these supported by significant detail. This will give a chance for wide reading, class discussion, comparison, grouping, assimilation and fixing important relations. Herein lies the chief value of teaching history. Proceed from cause to effect. Interpret the past in terms of the present. Correlate geography with the events and facts of history. The influence of physical features, such as rivers, coast waters and mountains, on the habits, warfare, and mode of living, should be made a large part of the historical work. Students should keep note books. These should contain the records of discussion in class, outlines for readings and additional facts gained from the teacher and from collateral reading.

Great care should be exercised in taking notes as this sort of work well done will be of great value to the student in the future. Teachers are urged to keep in close touch with notebook work. Much written work at the blackboard, is of doubtful value. Frequently, a period of history is illuminated through the reading of an historical novel.

The Committee of Ten recommends an intensive study of a brief period in history. This suggests a good method for the study of American history in the fourth year. Too frequently the history of the United States consists of a general review of the same text and by the same methods employed in the elementary grades. The

subject matter should be presented from a new point of view, large topics intensely studied, full of detail, and calling forth much reading, and discussion. The practice in many of our high schools of reviewing the history of the United States in two months for the sake of passing a teacher's examination is to be deplored. This is nothing more than a cram which is very injurious to the mind. It is not absorption but assimilation that is educative.

To teach history properly requires an adequate equipment. Pupils should have access to more than one textbook. Every high school should provide a number of well-selected reference books on history, covering all the different fields, a good atlas, encyclopedia, maps, and source material.

Every teacher should be interested in the purchase of reference books for teachers. Such books contain the best that has been said on the subject, and furnish a guide along proper lines of teaching and study.

Books for teachers:

Bourse, Teaching of History and Civics, Longmans.
Report of the Committee of Seven, Macmillan.
Report of Committee of Ten, American Book Co.

HISTORY OUTLINES.

(Reprinted, by permission, from the Teachers' College Record for March, 1906.)

First Year.

A. ORIENTAL HISTORY.

I. Egyptians.
II. Assyrians.
III. Hebrews.
IV. Phoenicians.
V. Persians.

Brief study of political, social and economic conditions, art, architecture and the work of archaeologists.

B. GRECIAN HISTORY.

I. Land. Drill upon geographical work, the spelling and the pronunciation of ancient names.
II. The People. Origin, character, typical organization, and institutions.

III. The rise of the Greek cities and the development of Greek political freedom. Colonization, sports, Athens, the defense of Greek freedom as seen in the Persian wars, the period of Athenian greatness.

IV. The decline of Greek freedom as shown by the conflict for leadership. Sparta, Thebes, Macedon.

V. The Graico-Oriental world. The mingling of East and West under Alexander the Great.

C. ROMAN HISTORY.

I. The land. Study of physical conditions and their relations to the development of the peoples inhabiting Italy. Comparison with geography of Greece.

II. Conditions existing in Rome at the beginning of the historical period.

(1) Extent of territory under Roman control.

(2) Organizations as developed in the Regal period.

(3) Decline of kingship and development of Republican forms.

III. Rome as a Republic.

(1) Internal conflict. Steps in the struggle for the extension of class privileges.

(2) Expansion of Rome.

(a) The unification of Italy.

(b) The winning of the Mediterranean.

(3) The organization of conquered territory under Roman rule.

(4) Civil strife.

(a) New class difficulties.

(b) Attempts at peaceful reforms.

(c) Development of military monarchy.

IV. The Roman Empire. A topical survey of the institution of the Empire, the development of absolutism, the reorganization of the Empire under Diocletian and the adoption of Christianity under Constantine. The economic and social conditions of the Empire. Intellectual and architectural remains.

Second Year.

Mediaeval History.

A. TRANSITION.

I. The Teutonic Barbarians..

II. The Empire before the Barbarian invasion. Rapid review of development of the Roman Empire, relation to new forces without and within.

III. The Christians. The new force within the Empire destined to absorb and control it.

IV. The church. Its organization and political importance.

V. Monasticism. As a criticism of the worldliness of the church organization necessary to satisfy the demand for better opportunity to cultivate the ascetic ideal.

VI. The Era of Justinian. A period of reconstruction.

VII. The Byzantine Empire. The decline and fall of the Easetern Empire. The encrachments of the Saracens.

VIII. The Rise of Islam. The force which made Christendom conscious of its limitations and aided in bringing about the complete fusion of Roman and Teuton. The Med iaeval type.

IX. The Rise of the Franks. The power that checked Islam in the West.

X. The Holy Roman Empire under Charlemagne the old Roman Empire, the Christian church, and the Teutonic Barbarian completely fused, the Mediaeval type closely established.

B. MEDIAEVAL EUROPE.

XI. Feudalism. The form of organization which of necessity arose to control political, social, military, and economic conditions in an age of confusion.

XII. France. Development through its struggle with feudalism, the formation of national unity.

XIII. Germany. The way in which feudalism and the Italian complications effected the development of monarchy in Germany.

XIV. Conflict between Empire and Papacy. The relation of emperors to popes and popes to emperors.

XV. The Mediaeval church at the height of its temporal power. The unifying force of the Middle Ages, its organization, doctrine, extent of its control.

XVI. The Crusades. As illustrative of the Mediaeval spirit, importance from economic standpoint.

XVII. Mediaeval learning. Review of intellectual conditions from Augustan Age to the Renaissance.

XVIII. The Hundred Years' War. Its influence upon the development of the English and French monarchies.

XIX. The Italian cities and the Renaissance. Wealthy, independent cities as centers of progress in art and letters.

XX. Rise of the Hapsburgs and the ascendancy of Spain. The stronghold of Catholic faith and papal support.

XXI. The Protestant revolt in Germany. As a revolt against authority.

XXII. The Catholic Reformation and the Rise of the Dutch Republic. The determination for religious freedom leads to political independence.

XXIII. The Thirty Years' War. The last great conflict caused by difference between Catholics and Protestants. The growing prevalence of political rather than religious motives.

C. MODERN EUROPE.

XXIV. The ascendancy of France under Louis XIV. France as a type of Absolutism.

XXV. Rise of Russia and Prussia. Organization and consolidation of Eastern Europe.

XXVI. The French Revolution; the end of the "old order."

XXVII. Europe and Napoleon; attempts to establish again the Empire under Napoleon.

XXVIII. The unification of Germany; unity through confederation under Prussian leadership.

Third Year.

ENGLISH HISTORY.

I. Geography of Great Britain and Ireland.

II. Infusion of social elements. To 1154.

(1) Pre-Roman Britain. Records; degree of civilization attained; survivals.

(2) Roman Britain. 43-410 A. D. Conquest; Romanizing of the province; decay of Roman Britain.

(3) Teutonic Britain. To 1066. Conquest and settlement; introduction of Christianity and development of ecclesiastical unity; development of political unity prior to Alfred; first period of Danish conquests; Wessex and Alfred the Great; political unity in the 10th century; English civilization in the 10th century; second period of Danish conquest; restoration of the English.

(4) Norman Britain—1066-1154. The Norman conquest of England; means by which William established his rule; effects of the conquest on language, architecture, feudalism, government, the church; civil war.

III. Foundation of the nation, 1154-1216. Extension of the English possessions; reorganization of the government and the possession of the judicial system; conquest of Ireland; England and the Crusades; loss of the French possessions; conflict with the church; Magna Carta; fusion of social elements.

IV. Formation of a united English people, 1216-1327. Struggle against arbitrary rule, Henry III; constitutional growth under Edward I; conquest of Wales; attempted conquest of Scotland; struggle against arbitrary rule, and its constitutional results, Edward II; social and economic conditions of the 13th century.

V. A period of foreign war and internal strife, 1327-1485. The Hundred Years' War; the War of the Roses; growth of parliamentary rule; rise of the "New Monarchy"; social and economic change of the 14th and 15th centuries.

VI. The Tudor despotism, 1485-1603. The Tudor despotism established; the Protestant revolt; the Catholic reaction; the religious settlement under Elizabeth; Protestant revolt in Scotland; Elizabeth and Mary Stuart; the Spanish war; discoveries and explorations; growth of English commerce; development of manufactures and the shifting of manufacturing centers, enclosures; pauperism; Ireland; literature; the "new learning;" the "Elizabethan Age."

VII. Struggle against absolute monarchy, 1603-1688. Preparation for the conflict under James I and Charles I;the Civil War; the Commonwealth and Protectorate; the restoration; revolution of 1688; colonization.

VIII Foundations of the British Empire, 1689-1815. The struggle for Empire—the Second Hundred Years' War; constitutional changes and the rise of the early party government; union with Scotland and Ireland; the Evangelical movement; Industrial Revolution; England and the French Revolution; literature.

IX. A period of democracy and reform, 1815-1909. Social, political, religious, economic reforms in England; Ireland and reform; growth of democracy; the eastern question; expansion of the British Empire and plans for imperial federation; party government perfected; the Boer War; literature.

Fourth Year.

*UNITED STATES HISTORY.

I. Formation of the nation, 1492-1763.

(I) Geography of the United States.

(II) Discovery.

*Outline abbreviated.

(III) Colonization of America.
1. Colonization in the 16th century.
2. English colonization, 1607-1732.
   (1) Southern colonies.
   (2) New England colonies.
   (3) Middle colonies.

(IV) Conflict between France and England for supremacy.
1. 1689-1763; conditions leading to conflict.
2. The Intercolonial Wars and their results, 1689-1763.

(V) Economic, social, and political condition of the English colonies in 1760.

II. A nation in the transit, 1763-1789.
   (I) Separation of the English colonies from the mother country.
   (II) Formation of the union.
      (1) Critical period, 1783-1789.
         a. The Confederation.
         b. The Constitution.

III. The development of nationality, 1789-1860.
   (I) Period of Federalist supremacy, 1789-1801.
   (II) Period of Republican supremacy, 1801-1815.
   (III) Period of reorganization, 1815-1829.
   (IV) Democracy in the ascendancy, 1829-1845.
   (V) Slavery question uppermost, 1854-1860.
      1. Extension of territory; settlement of Oregon question; Mexican war.
      2. Extension of slavery.

IV. The nation tested, 1860-1865.
   (I) Secession. Secession in the cotton states; policy of Buchanan; attempts at compromise; formation of Southern Confederacy; policy of Lincoln.
   (II) The Civil War, 1861-1865. Resources of contestants; attitude of foreign powers; study of strategic points; military events; emancipation policy; cost of war; constitution during the war.

V. Expansion of the nation, 1865-1909.
   (I) Economic and political reconstruction of the South; condition of the South at the close of the war; presidential and congressional reconstruction; the "New South," and the race problem.
   (II) Some of the leading social and political problems since 1865.

VI. A brief study of some of the more important facts of civil government.

CIVICS.

Since many high schools prefer to have civil government earlier in the course than the fourth year, and because a large number of the high schools have only two years, it is perhaps wise to put this study in the first year of the high school course. Two periods per week through the entire year will be sufficient to cover the essentials of civics. The work done should comprise a brief treatment of local, state, and national government. During the last year of the course of a first-class high school, the more difficult topics may be studied in connection with American history. "It is expected that good teachers in dealing with history throughout, and especially with American history, will constantly refer to the forms and functions of government with which the children are most familiar."

SCIENCE.

First Year, Physical Geography.

I. The earth as a whole.
- A. Its relation to the sun and universe.
- B. Its relation to the other planets.
- C. Its shape. (Proofs.)
- D. Size.
  - (1) Compare with sun, moon and the planets.
  - (2) How determined?
- E. Nations of the earth.
  1. Rotation and effects.
  2. Revolution and effects.
- F. Location upon its surface.
  1. Determined by latitude and longitude.
  2. Lines on earth used in longitude.
  3. Lines located by earth's inclination.
  4. Maps.
- G. Magnetism; compass and its variations.

II. The Atmosphere.
- A. Its height and weight; barometer, isobars.
- B. Composition. (A mixture.)
  1. Use of each constituent. (Make and experiment with oxygen and nitrogen.)
  2. Dust and its effects.

C. Heat of the atmosphere.
1. The thermometer. Its principle.
2. Isothermal lines.
3. What are the factors influencing temperature.

D. Moisture.
1. Evaporation—cause—variation—when will it cease?
2. Relative and absolute humidity; the hygrometer; dew point.
3. Condensation. Cause and forms.

E. Circulation.
1. Causes of wind and its benefits.
2. Cyclones, tornadoes, cloudbursts.
3. Periodic and variable winds.
4. Climate.
(a) Weather and weather maps.
(b) Meteorology.

III. The Land.
A. Interior of the earth.
B. Movements in earth's crust.
1. Elevation and subsidence.
C. Mountains, plateaus, and plains.
1. How formed?
2. Influence on people, climate, and industries.
D. Volcanoes.
(1) Distribution; (2) Theories concerning; (3) Phenomena
E. Earthquakes.
(1) Theories concerning; (2) Historic earthquakes; (3) Instruments.
F. Rivers.
(1) Erosion.
(2) Sedimentation.
G. Lakes.
(1) Relation to rivers.
(2) Salt lakes and their cause.
H. Glaciers, past and present.
I. Forces causing changes in land now.
J. Life-forms and their distribution.

IV. The Ocean.
A. Depth, density, temperature, and composition.
B. Movements.
1. Waves—cause and effects.
2. Currents—cause and effects.
C. Erosion and deposit.
D. Ocean floor.
E. Life in the ocean.

The work outlined should be supplemented by field excursions and by as many experiments as time will permit. Lantern slides, pictures, maps, weather maps, and geographical books will greatly aid the work.

Reference books for Teachers.

Davis—Meteorology—Ginn & Co.
Dodge—Reader in Physical Geog.—Longmans.
Tarr.—New Phys. Geog.—Macmillan.
Physiography of the United States—American Book Co.

Second Year.

BOTANY.

In the study of this subject, high school pupils frequently enter for the first time the "fairy land of science." Every school is surrounded with a wealth of material and it is the privilege of the earnest teacher to remove the seals from the book of nature and create enthusiastic readers for life. In no other subject is the call for spirited leadership more imperative. It is better to omit the course entirely than to entrust it to a teacher who has no interest in the subject except to cover a prescribed number of pages in a text-book, in a given time.

Schools that give but a seven months' term ought to spend the entire time on this subject, rather than to divide the time between zoology and botany. Where the term is nine months long, it is entirely possible to consider some important topics in both branches of natural history. The determination of these topics is the most difficult task of the teacher.

Dr. Hodge, of Clark University, stated in his lecture before the High School Department at Harrisburg, that, "In preparation for active citizenship let the biology of the high school center about the life, interests, and problems of the town or city, the state or nation. Do the highest interests of the community require that its educated citizens know this or that, is the question which should determine whether a topic be admitted to the high school course.

"In the college the student enters the world of pure science. Here for the first time, not the need of the child or community, but the logical development of the subject matter must dominate. The nature-study point of view is to teach the child. The scientific point of view is to teach the subject."

With this great purpose before him, the teacher must choose from a great variety of material. Laboratory work with a compound microscope as an aid is an important part of the course. Carefully kept note books illustrated by drawings of many things studied will give a valuable training. A study of native trees, of economic plants such as cotton or rice, of weeds, of parasitic plants, of wild flowers, of garden flowers, or of ferns may be emphasized to add interest and variety to the regular work.

The season of the year and the availability of material will determine the order of topics in the following:

OUTLINE OF BOTANY.

1. Seeds and seedlings.
2. Seed distribution.
3. The plant as a whole.
   a. Root.
   b. Stem.
   c. Leaves.
   d. Flower.
   e. Fruit.
4. Study of several flowers.
   a. Notice resemblances.
   b. Pollination. Wind, insects, and gravity.
5. Microscopic study of cells.
6. Stems and buds. (In winter.)
   a. Exogens.
   b. Endogens.
7. Study of trees.
   a. Recognition by flower and fruit.
   b. Recognition by bark and cross section.
   c. Recognition of lumber.
   d. Uses.
   e. Care of trees.
   f. Spraying.
   g. Tree planting.
8. Analysis of flowers (possibly 25 specimens.)
   a. Preparation of herbarium.
   b. Field excursions.
   c. Represent as many families as possible.
9. Lower plants.
   a. Algae.
   b. Fungi—Bacteria, yeast.
   c. Moss.
   d. Ferns.

10. Insectivorous plants.
11. Botany and agriculture.
    a. How plants drink.
    b. How fluids move in root and stem.
    c. How plants breathe.
    d. Chlorophyll and food making.
    e. Storage of food.
    f. How plants grow.
    g. Effect of heat, light, moisture, contact, and gravity.
    h. Plant protection and adaptation.
12. Forestry.

BOOKS FOR TEACHERS.

Ganong, The Teaching Botanist, Macmillan.
Coulter, Plant Relations, Appleton.
Coulter, Plant Structures, Appleton.
Setchell, Laboratory Practice for Beginners, Macmillan.
Bulletins issued by State College Department of Agriculture.
Bulletins issued by Pennsylvania and United States Departments of Agriculture.

ZOOLOGY.

There is more opposition among pupils and patrons, to the study of zoology than to any other science found in the curriculum of the high school. This is doubtless due to poor teaching and erroneous notions about the subject itself. If the same test be applied to topics in zoology that is suggested in botany, much of this opposition may be overcome. Unless proper selection of material and topics is made, it would be best to omit the subject from the course. Where a choice must be made between zoology and botany or zoology and agriculture, the omission of zoology is recommended. All pupils have a natural and healthy interest in living things and the work in zoology should seize upon this trait and so direct it, that the course may be very profitable. The material is at hand in Pennsylvania for work in each of the great groups of animals.

If some insect as the fly, the craw-fish, the earth worm, the amoeba, the star-fish, the mussel, a common fish, the frog, the sparrow, and some common mammal as the cat, are studied as type-forms, a broad course is offered.

The economic questions involved in the extermination of the native birds, and the great increase in the English sparrows, should receive attention. The destructive animals and means of destroying them, either natural or scientific, should be studied. In fact the whole course could well be devoted to the study of the animal problems of the farm. The grasshopper, the coddling-moth, the army worm, the cutworm, the borer, the caterpillar, the rose-bug, the potato bug, and the various scales are destroying annually more property than was ever threatened by an invading army. If the course in zoology will aid in the solution of these problems, the above mentioned opposition will soon disappear.

BOOKS FOR TEACHERS.

Hodge, Nature Study and Life, Ginn & Co.

Lubbock, Ants, Bees, and Wasps, Appleton.

Comstock, Manual for the study of insects, Comstock Publishing Company.

Seton, Wild Animals I Have Known, Scribners.

Bulletins of Departments of Agriculture, both state and national.

PHYSICS—THIRD YEAR.

No other scientific subject is so universally taught in the high schools of the state as physics. It is therefore essential that certain standards be definitely established. It is folly to undertake the study without proper equipment. This must include apparatus for the students, available for a considerable group at the same time, that they may work out for themselves a large number of quantitative experiments.

Simplicity is an important quality in apparatus and as a result, great expense may easily be avoided. Boards frequently make the mistake of spending large sums for single pieces or combinations, when less money would buy material better suited for laboratory work.

After apparatus is secured it should be carefully kept in dust-proof cases, provided with locks. The teachers should have the time and tools to keep the apparatus in good order. Laboratory work to be successful must be thoroughly supervised. A year of nine months is all too short to study a modern text-book and complete 40 laboratory experiments from the following list, recommended by the Committee of Ten.

EXPERIMENTS.

1. Measuring.
   - Meter stick,
   - Vernier,
   - Micrometer caliper,
   - Curve plotting.
2. Find volume, weight and density of several solids, as wood, stone, iron, etc.
3. From known weight of a given length of wire, calculate the length of a roll of fine wire from its weight.
4. Study the elasticity of stretching of rubber, or brass wire, and see whether the results agree with the laws.
5. Determine the elasticity of bending of wood as to length, breadth, and thickness, and see whether results agree with the laws.
6. Find the co-ordinates of a given curve drawn on co-ordinate paper, and plot a curve from given co-ordinates.

Mechanics of Fluids.

1. Pressure of liquids as to direction and depth.
2. Compressibility of air—verify Mariotte's law.
3. The buoyant force of a liquid by weighing in water and weighing the displaced water.
4. Relation of the volume of a regular solid to loss of weight in water.
5. Find the relative density of a number of substances heavier than water.
6. Relative density of a substance lighter than water by use of a sinker.
7. Relative density of wood by flotation.
8. Relative density of a liquid.
   (a) By weighing a substance in the liquid and in water.
   (b) By weighing the liquid and water in the same vessel, separately.
   (c) By Hare's method of balanced columns raised by exhaustion.
9. Relative density of air by exhaustion from a bottle.
10. Action of a siphon. By connecting two vessels of water by a rubber tube, determine the conditions causing the flow.
11. Find the weight of a column of mercury in a tube, per centimeter, by measuring its length, and weighing the mercury.
12. Calculate the pressure of the atmosphere by weight of a column of mercury.

Mechanics of Solids.

1. The principles of the composition and resolution of forces; by the action of three forces in the same plane and not parallel, using spring balances; also by construction, using the parallelogram of forces.
2. The law of distances of points of application of two parallel forces from the points of application of their resultant, or equilibrant.
3. Law of the moments of two parallel forces acting on a body.
4. Moments about a fixed point of any number of parallel forces in the same plane.
5. Moments of two sets of parallel forces, or couples, in the same plane.
6. Centre of gravity of a material rod. By use of extra weights find the point where the weight of a material body acts.
7. Centre of gravity of a material triangle.
8. Comparison of masses by inertia.
9. Relation of the time of vibration of a pendulum to its length.
10. Relation of friction to pressure.
11. Work done in moving bodies up an inclined plane.
12. Relation of the acceleration of falling bodies to the moving force.

HEAT.

1. Verifying the freezing-point and boiling-point of a thermometer.
2. Linear expansion of a solid.
3. Heat-capacity of a calorimeter.
4. Specific heat of a substance.
5. Latent heat of water.
6. Latent heat of steam.
7. Dew-point of the air of the room.

SOUND.

1. Pitch of a tuning-fork by a column of air in a vessel.
2. Relation of pitch to length of wires.
3. Relation of pitch to tension in wires.

LIGHT.

1. Photometry; relation of intensity to distance of a light.
2. Relation between the angle of incidence and the angle of reflection of light.

3. Position of images in plane mirrors.
4. Find the critical angle of water.
5. Find the critical angle of kerosene.
6. Find the focal length of a converging lens.
7. Size and position of real images in a converging lens.
8. Size and position of the virtual images in a converging lens.

ELECTRICITY.

1. Mapping the lines of magnetic force for a bar-magnet.
2. Constancy of the two-fluid Daniell's cell, and change of weight of the elements of the cell.
3. Electrical resistance, as to length and cross-section of conductors.
4. Measurement of resistance by substitution.
5. Measurement of resistance by Wheatstone's bridge.
6. Electromotive force of different metals.
7. Electromotive force of cells as to size and number, placing them in opposition.
8. Method of connecting-cells with reference to external resistance. Compute the current-strength, using the formula

$$C = \frac{E}{R+r}.$$

9. Law of induced currents as to duration and direction.

The apparatus required will depend upon the experiments selected and the scope of the work as planned by the teacher. The following list of apparatus is intended to be suggested as a minimum for schools attempting work in physics. It may be and should be greatly increased as the needs of the work develop.

CLASSIFIED LIST OF APPARATUS FOR LABORATORY WORK.

Mechanics.—Meter sticks, spring balances, Harvard trip balance (2), supports for trip balances, air pumps, force and lifting pumps (model), alcohol lamps or Bunsen burners, pulley system, wheel and axle, inclined plane with car, specific gravity bottle, hydrometer jar and hydrometer, barometers, mercury (4 lbs.), glass and rubber tubing (assorted), flasks, corks, funnels, tools, etc.

Sound.—Sonometer, C and G tuning forks, resonance tubes, siren, rotating apparatus, etc.

Heat.—Thermometers, calorimeters, model engine, (glass cylinder and chest), linear expansion apparatus (lever form), still and condenser, etc.

Light.—Prisms, lenses, mirrors, curved and plane, color disc, etc.

Electricity and Magnetism—Bar magnets, compass, vulcanite and glass rod with good silk cloth and catskin, Toepler-Holtz machine, electroscope, Leyden jar, electrophorus, electric cells, dynamo and motor, induction coil, telegraph key and sounder, electric bell, galvanometer, volt ammeter, horse-shoe electro magnet, small incandescent lamp, etc.

REFERENCE BOOKS FOR TEACHERS.

Carhart, University Physics, 2 volumes, Allyn and Bacon.

Ganot, Physics, William Wood and Co.

Lodge, Pioneers of Science, Macmillan.

Duncan, The New Knowledge, A. S. Barnes and Co.

Smith and Hall, The Teaching of Chemistry and Physics, Longmans.

Whitham, Recent Developments of Physical Science, P. Blackiston.

Hopkins, Experimental Science, Munn and Co.

S. P. Thompson, Elementary Lessons in Electricity and Magnetism, Macmillan.

School Science and Mathematics, Monthly, Published in Chicago.

Fourth Year.

CHEMISTRY.

Schools that maintain a three years' course should not undertake this subject at all, and without facilities for laboratory work, its study is of very doubtful value in any school. Experience shows that a year of nine months is necessary for effective work. Probably the best division of the time is in the proportion of three recitation periods to two double laboratory periods per week. The size of the laboratory groups will be determined largely by the facilities, but not more than twenty pupils can be properly supervised in experimental work.

The purpose of the course in secondary schools is mainly disciplinary. It provides excellent training in observation and in logical thinking and gives a knowledge of important natural and industrial processes. The ability to do, to observe accurately, to make logical

inferences, and to express results in good English, is of more value than the acquisition of many facts, however important. With this aim admitted, the laboratory note book becomes the center of interest for the teacher. He must assure himself that his pupils are thinking and not doing their work mechanically. Descriptions of experiments should be written at the time they are performed.

The use of the chemical equation and formula should be restricted, especially in the earlier part of the work. Analytic work can not be emphasized in a course that is so limited in time.

In order to give a practical training in the course such subjects as the following might receive greater emphasis than the text-books usually give them: Chemistry of cooking, of the laundry, of making soap, of soils, and of foods. If the school is located in a manufacturing community, visits should be made by the class to the works, and any chemical processes used, should receive special attention.

Text books and manuals usually give lists of apparatus and supplies necessary to carry on the work outlined.

APPARATUS.

Apparatus required for each pupil doing laboratory work.—Beakers (2), thistle tube, glass funnel, evaporating dish, filter paper (50 sheets), test tubes (12), test tube rack, glass stirring rod, gas receivers (2), files (2), round and triangular, tubing, glass and rubber (assorted), corks, Bunsen burner, graduates, flasks (2), large and small, asbestos gauze, matches (safety), litmus paper, pneumatic trough or sink, ring stand, rubber stoppers, tripod (iron), and a watch glass.

General apparatus available for all.—Chemical balance (in a case), barometer, blast lamp, (Bunsen's), reagent bottles, blow pipes, Woulff's flasks (2 neck), mortars and pestles, deflagrating spoons, spatulas, wire (copper and platinum), cork borers, cork press, hood with good draft, jars (crockery for waste glass and chemicals), thermometer (centigrade), burettes (Mohr's), eudiometers, wire gauze, pinch cocks, weights, good still, tables equipped with gas and water, etc.

The experiments recommended by the Committee of Ten will be found to be entirely satisfactory by any teachers desiring aid in selection.

REFERENCE BOOKS FOR TEACHERS.

Smith and Hall, The Teaching of Chemistry and Physics, Longmans.

Tilden, Hints on teaching chemistry, Longmans.

Remsen, Chemistry, advanced course, Holt.

Dobbin and Walker, Chemical Theory for Beginners, Macmillan.
Newth, Inorganic Chemistry, Longmans.
Ostwald-Findlay, Inorganic Chemistry, Macmillan.
Jones, Modern Theory of Solutions, American Book Co.

AGRICULTURE.

This comparatively new subject in the schools of Pennsylvania is rapidly growing in popularity with those patrons who insist that education should be more practical. Teachers must meet the demand by preparing themselves to teach such a course as the following taken from Circular No. 77, issued by the United States Department of Agriculture, office of experiment stations. It contains much other valuable material and should be in the hands of every teacher of agriculture. In rural high schools agriculture may take the place of any of the sciences suggested in the course of study.

Syllabus on Agronomy for Secondary Instruction.

The following syllabus has been prepared not only to give the teacher the limits of the subject to be taught, but to present the point of view from which the subject should be taught. A Japanese scholar, while speaking before an American audience recently, remarked: "I noticed one very marked difference in the agriculture of Europe and America from that of Japan. In Europe and America you work the soil; in Japan we are interested in growing crops." This syllabus has been prepared from the Japanese point of view, namely, that the aim in agronomy is the production of plants useful to mankind, a definition this committee gave to agronomy in its third report in 1898.

In this syllabus emphasis is not placed upon soil, tillage, drainage, and irrigation as such, but upon the relation of soil, tillage, drainage, and irrigation to the environment of the plant, namely to light, heat, moisture, air, plant food and repressive agencies. The special province of the agronomist is to consider how soil, tillage, drainage, irrigation, and the various cultural methods of the farmer may modify the environment and thus increase the crop, and, so far as man may modify the environment, how it may be accomplished economically. No less important is the influence of heredity in the production of crops and the practical methods by which plants may be improved.

To what extent the teaching will be confined to a consideration of man's influence in making use of fundamental laws and how much time will be employed in stating fundamental laws must depend upon the thoroughness with which the student has studied botany, physiology, and chemistry.

In any case the application of these fundamental laws must be made. For example, if the students have had chemistry, the teacher must spend some time in considering the function and relation of the 14 elements chiefly concerned in the production of soil, air, plants, and animals. If, however, the students have not had any chemistry, it will be necessary in addition to spend some time in teaching the students the alphabet of chemistry. From the syllabus it will be seen that the plant may be studied from the standpoint of its composition, structure, physiology (activities), heredity, and environment. Since a plant is the result of two forces, its heredity power and its environment, general consideration is first given to the methods of plant improvement and to those cultural methods by which the plant's environment is modified. Following these general considerations each individual crop may be studied from the standpoint of its structure, its composition, its physiology or activities, its heredity or improvement, its environment or cultural methods, and, finally, its economical use and disposal. The number and kind of crops to be studied will vary with the time at the disposal of the teacher, and to some extent at least, with the character of the local agricultural industries. The syllabus outlines an illustration of the order and possible topics for discussion, leaving it to the teacher to select those that may be best employed. It is not expected that any high school will be able to teach all the topics here mentioned.

SYLLABUS.

1. The plant, how studied:
    1. Composition.
    2. Structure.
    3. Physiology.
    4. Heredity.
    5. Environment.
2. Composition:
    1. Essential elements.
    2. Function of elements.
    3. Water.
    4. Ash.
    5. Protein.
    6. Carbohydrates.
        1. Cellulose.
        2. Starch.
        3. Sugars.
    7. Fat.
3. Structure:
    1. Cells.
    2. Roots.
    3. Stems.
    4. Leaves.
    5. Inflorescence.
4. Physiology:
    1. The plant activities.
    2. The processes of growth.
    3. Irritability.
    4. The kinds of propagation.
    5. Propagation by seeds.
    6. Propagation by buds.
5. Heredity:
    1. Principles.
    2. Processes.

5. Heredity—Continued.
    3. Steps in improvement of plants.
        1. Variation.
            1. Environment.
            2. Crossing.
        2. Selection.
        3. Testing hereditary power.
    4. Illustrations of improvement in plants.
    5. Methods of improvement.
6. Environment:
    1. Light.
    2. Heat.
    3. Moisture.
    4. Air.
    5. Plant food.
    6. Repressive agencies.
7. Light and heat:
    1. Relative interdependence.
    2. Effect.
    3. Influence of character of light.
    4. Influence of seasons.
    5. Temperature for germination and growth.
    6. How modified.
        1. Color.
        2. Evaporation.
        3. Topography.
        4. Character of soil.
        5. Cultivation.
        6. Drainage.
        7. Rolling.
        8. Thickness of planting.
        9. Fermentation.
        10. Artificial means.
            1. Screens.
            2. Electricity.
            3. Artificial heat.
8. Moisture:
    1. Purpose.
    2. Importance.
    3. Quantity required.
    4. How modified.
        1. Kind of soil.
        2. Topography.
        3. Fertilizers and other amendments.
        4. Cultivation.
        5. Drainage and irrigation.
9. Air:
    1. Function above ground.
        1. Oxygen.
        2. Carbon dioxid.
    2. Function in soils.
        1. Oxygen.
        2. Nitrogen.
        3. Removal of carbon dioxid.
    3. Processes of soil ventilation.
        1. By diffusion.
        2. By expansion and contraction of air due to temperature.
        3. By expansion and compression due to barometric pressure.
        4. Suctional effect of gusts of wind.
        5. Air absorbed by rain water.
        6. By removal of water, through drainage, evaporation, and transpiration of plants.
10. Plant food:
    1. Elements needed.
        1. Function.
        2. Sources.
            1. Air.
            2. Soil.
            3. Fertilizers.
11. Soil:
    1. Functions.
    2. Properties.
    3. Kinds.
    4. As a source of plant food.
        1. Importance compared with other sources.
        2. How modified.
            1. Kind of soil.
            2. Topography (erosion).
            3. Tillage.
            4. Drainage and irrigation.
            5. Fertilizers.
            6. Systems of cropping.
12. Kind of soil.
13. Topography.
14. Tillage:
    1. Purpose and effects.
    2. Methods.

15. Drainage:
    1. Purpose and effects.
    2. Methods.
16. Irrigation:
    1. Purpose and effects.
    2. Methods.
17. Fertilizers:
    1. According to constituents.
        1. Nitrogenous.
        2. Phosphoric.
        3. Potassic.
        4. Other amendments.
    2. According to form.
        1. Farm manures.
            1. Green manures.
            2. Animal manures.
        2. Commercial fertilizers.
18. Farm manures:
    1. Properties.
    2. Sources.
    3. Uses.
    4. Preparation, care, and handling.
    5. Application.
    6. Economy.
19. Commercial fertilizers:
    1. Sources.
    2. Uses.
    3. Application.
    4. Economy.
20. Nitrogen:
    1. Source.
    2. Fixation of free nitrogen.
        1. With certain plants.
        2. Without plants.
        3. Organisms.
        4. Cause of tubercles.
        5. Effect of organisms.
        6. Influence of conditions.
    3. Nitrification.
    4. Denitrification.
    5. Loss through drainage.
21. Repressive agencies:
    1. Insect and other animals.
    2. Diseases.
    3. Weeds.
    4. Unfavorable weather.
    5. Acidity and alkalinity of soil.
    6. Toxic agencies.
22. Rotation of crops:
    1. Principles.
    2. Systems.
23. Classification of economic plants:
    1. Cereals.
    2. Grasses.
    3. Legumes.
    4. Vegetables.
    5. Fruits.
    6. Tubers.
    7. Roots.
    8. Sugar plants.
    9. Oil plants.
    10. Fiber plants.
    11. Stimulants.
    12. Medicinal and aromatic plants.
24. Cereals:
    1. Wheat.
    2. Indian corn (maize).
    3. Oats.
    4. Barley.
    5. Rye.
    6. Rice.
    7. Sorghum.
    8. Buckwheat.

    (Other groups of plants may be classified in like manner.)
25. As many individual crops may be treated as time will permit.

An outline of topics on wheat is submitted, which is believed to be much too complete for secondary instruction, but may be readily modified to suit the character of instruction required.

WHEAT.

A. Structure:
    1. Relationships; 2, roots; 3, culms; 4, leaves; 5, tillering; 6, organs of reproduction; 7, the true flower; 8, the spikelet; 9, the spike; 10, the grain; 11, the embryo; 12, the endosperm; 13, the aleurone layer; 14, the bran; 15, physical properties.

B. Composition:
    1. Composition; 2, water; 3, ash; 4, protein; 5, gluten; 6, relation of weight per bushel to nitrogen content; 7, influence of environment on composition of grain; 8, germination.

C. Botanical relations:

1. Species of wheat; 2, Einkorn; 3, Spelt; 4, Emmer; 5, Common wheat; 6, Club, or square-head wheat; 7, Poulard wheat; 8, Durum wheat; 9, Polish wheat; 10, spring and winter wheats.

D. Classification of varieties:

1. The importance of variety; 2, the best variety; 3, variety names; 4, pedigree wheat; 5, number of varieties; 6, variety characteristics; 7, variety groups; 8, desirable qualities; 9, score card; 10, market classification; 11, soft winter varieties; 12, hard winter varieties; 13, hard spring varieties; 14, white varieties.

E. Improvement of varieties:

1. New varieties; 2, the introduction of foreign varieties; 3, improvement by selection; 4, varieties through crossing; 5, the possibility of cross-fertilization; 6, the law of cross-fertilization; 7, importance of crossing as a method of improvement; 8, method of finding and testing new strains or varieties.

F. Climate:

1. Condition of successful wheat culture; 2, effect of climate upon geographical distribution; 3, effect of climate upon quality; 4, effect of climate upon growth; 5, accumulation of soil constituents at different stages of growth; 6, winterkilling.

G. The soil and its amendments:

1. The choice of soil; 2, effect of change of soil on yield; 3, the use of fertilizers; 4, indirect fertilization; 5, rotations; 6, carriers of fertilizing constituents; 7, relative importance of fertilizing constituents; 8, amount of fertilizers; 9, time and manner of applying commercial fertilizers; 10, farm manure; 11, mulching.

H. Cultural methods:

1. Time of plowing; 2, depth of plowing, 3, preparing seed bed without plowing; 4, time of sowing; 5, depth of sowing; 6, drilling compared with broadcasting; 7, quantity of seed per acre; 8, influence of size of seed; 9, treatment of seed; 10, wheat-seeding machinery; 11, cultivation; 12, rolling.

I. Weeds, fungus diseases, and insect enemies:

1. Weeds: (a) chess or cheat; (b) darnel; (c) cockle; (d) wild garlic; (e) wheat-thief; 2, fungus diseases: (a) rust; (b) wheat scab; (c) loose smut; (d) stinking smut; 3, insect enemies of growing wheat: (a) chinch bug; (b) Hessian fly; (c) wheat joint-worm; (d) wheat midge; (e) grain aphides; (f) army worm; (g) grasshoppers.

J. Harvesting and preservation:

1. Date of harvesting; 2, influence of maturity on yield; 3, influence of ripening upon composition; 4, influence of shocking; 5, method of shocking; 6, methods of harvesting; 7, self-rake reaper; 8, the self-binding harvester; 9, the header; 10, the combined harvester and thrasher; 11, thrashing; 12, storing; 13, elevators.

K. Uses and preparation for use:

1. Uses; 2, food for domestic animals; 3, source, amount, and quality of flour; 4, grades of flour; 5, graham and entire wheat flour; 6, amount of bread from flour; 7, milling machinery; 8, purifier; 9, the by-products of wheat; 10, composition of by-products; 11, food value of by-products.

L. Production and marketing:

1. Wheat crop of the world; 2, wheat crop of the United States; 3, progress of wheat production; 4, center of wheat production; 5, winter wheat and spring wheat; 6, production of flour; 7, consumption of wheat per capita; 8, yield per acre; 9, cost of production; 10, export of wheat and flour; 11, imports of wheat; 12, commercial grades.

M. History:

1. Antiquity; 2, original habitat; 3, reasons for culture.

GENERAL INSTRUCTIONS TO TEACHERS.

Since this is a new subject for high school work it seems desirable to give detailed suggestions on a few subjects for study. These directions and questions are not intended to be mandatory, but are intended to help teachers who are giving this work for the first time. This work does not cover the entire syllabus. When the schools and teachers become better equipped the work may be extended. In preparing these lessons first attention has been given to the question as to whether bulletins and other material could readily be secured. Some topics of prime importance have been omitted because there are no bulletins that can be secured to supply the entire class for study, while topics of less importance have been included because good bulletins are available. The lessons are to aid in doing work under present conditions and are not intended to represent an ideal high school course.

The study of agriculture gives the same sort of educational development as is given by the study of botany, physiology, physics, chemistry, and other sciences. From the unlimited number of subjects for scientific study it selects those which concern the plants and animals that are used on the farm. Each school should select for study the subjects that are of greatest importance in the community.

Since agriculture is based on so many sciences it is desirable that it follow the study of the other sciences that are taught in the school, particularly botany and chemistry. If a school can not teach chemistry it will be possible to give about two-thirds of the lessons outlined. But it is extremely desirable that chemistry be taught preceding the agriculture. It should be taught by the laboratory method. No work in high school agriculture should be attempted unless the school teaches botany. Those who wish to teach agriculture before they teach botany should use Office of Experiment Stations Bulletin 186, Exercises in Elementary Agriculture—Plant Production. Many of the exercises in that bulletin can also be used in high school work.

The student should thoroughly understand plant cells from a microscopical study of them; the embryo and its growth; tests for starch and proteids; the process of osmosis and the function of roots;

the structure of stomata and use that the plant makes of oxygen and carbon dioxid; the formation of starch, its transfer through the stem, and its deposit as stored food in seeds and tubers; the process of fertilization; the nature of a fungus disease, from a microscopical study of bread mold or other fungus.

All other science work that is taught will help in agriculture. The subjects under physiology that are of most value as a preparation for agriculture are: Respiration; the kinds of foods, their digestion and the part that each plays in keeping up the body; bacteria and sanitation. If physical geography or geology is taught, the subjects of most value in preparing for agriculture are: The air, the weather, and the formation of soils. If zoology is taught, the work on insects will be of most value in preparing for the following lessons.

The teacher who gives the elementary agriculture should have a good knowledge of elementary botany and chemistry, and it is very desirable that he have some knowledge of physics, zoology, and geology. It is also desirable that the teacher be a man who has had some farm experience or who has studied some agriculture.

REQUIRED FREE REFERENCES.

Write to each of the following addresses stating that you wish the publication mentioned for your high school library and in your class in agriculture. If the teacher finds that he desires any of these for his private library, he should write for additional copies. The set in the high school library should be kept complete for future classes. On receipt of these the loose bulletins should be bound, or they may be punched and tied together with strings, and manila paper may be used for covers. These should be put in some place where pupils will have free access to them.

(1) Secretary of Agriculture, Washington, D. C.:

Ask to have the school placed on the mailing list for the Monthly List of Publications, and to be sent the following:

1 set of Farmers' Bulletins suitable to the locality.

1 copy of the List of Publications for Free Distribution.

1 copy of the List of Bulletins for Sale.

1 copy of each of the reprints of the areas that have been surveyed by the Bureau of Soils in your State.

Also ask for as many copies of "Separates from the Yearbook," Nos. 83, 124, 159, 279, 310 and 329, as there are students in the class. One copy of this circular and of Office of Experiment Stations Bulletin 186 for each student will be convenient for some of the exercises. Also look over the list of recitations where pupils are to study Farmers' Bulletins. Make a list of these bulletins that you expect to use and send

for as many copies as there are students in the class. Where directions are given to "study and recite" on bulletins or extracts, it is expected that the teacher give out a copy to each pupil at the time when the lesson is assigned.

(2) Write to your Congressman for such copies of the Yearbook of the Department of Agriculture as he may have for distribution, stating that they are for your high school library.

(3) Write to your State experiment station for copies of available bulletins and reports, and ask to be placed on the mailing list.

(4) Write to the State board of agriculture and other agricultural societies for publications that they have for distribution.

(5) Copies of farm papers and country-life magazines are desirable for the high school reading table.

BOOK REFERENCES.

No references other than the above are absolutely necessary, but it is very desirable to have on the reference table one copy of as many of the following books as possible. At least half of these ought to be secured. If a cyclopedia of agriculture can be afforded it will be of much value. Several copies of each of the first four books will be desirable if the class numbers over half a dozen; also of the fifth book in regions where fertilizers are much used.

1. Physics of Agriculture, King.
2. Chemistry of Plant and Animal Life, Snyder.
3. Forage and Fiber Crops in America, Hunt.
4. Cereals in America, Hunt.
5. Fertilizers, Voorhees.
6. Experiments with Plants, Osterhout.
7. The Principles of Fruit Growing, Bailey.
8. The Fertility of the Land, Roberts.
9. The Farmstead, Roberts.
10. The Horticulturist's Rule Book, Bailey.
11. Corn Plants, Sargent.
12. The Practical Garden Book, Bailey.
13. The Soil, King.
14. Irrigation and Drainage, King.

The following are more elementary books.

15. Soils and How to Treat Them, Brooks.
16. Manures, Fertilizers, and Farm Crops, Brooks.
17. Principles of Agriculture, Bailey.
18. Agriculture for Beginners, Burkett, Stevens, and Hill.
19. First Principles of Agriculture, Goff and Mayne.
20. Elementary Agriculture, Bessey and others.
21. Agriculture through the Laboratory and School Garden, Jackson and Daugherty.
22. First Book of Farming, Goodrich.

EQUIPMENT.

It is desirable that the high school be equipped for regular laboratory work in botany, chemistry, and physics. If not so equipped, the following equipment is suggested for a class of ten in agriculture:

2 compound microscopes magnifying to 500 diameters, cost about $18.
2 balances for weighing to centigrams.
Spring balance.
1 dozen pint fruit jars.
1 dozen quart fruit jars.
4 dozen test tubes.
½ dozen beakers (drinking glasses may be substituted).
1 dozen 4-inch size flowerpots with saucers; 1 dozen 6-inch size flowerpots with saucers (tin cans and boxes may be substituted).
1 gasoline burner (a stove or laboratory burners are as good).
6 porcelain crucibles (iron spoons may be substituted).
2 thermometers.
Small magnifying glasses, magnifying 10 diameters.
1 "School set of economic seeds." These may be obtained at a nominal expense by writing to the Seed Laboratory, United States Department of Agriculture, Washington, D. C.

Other equipment required can be brought from home by students when it is needed.

It is essential that there be at least two windows at which plants may be kept growing for experimental purposes.

Whenever possible, it is desirable that several acres of land be available for school use. Those who are laying out new school grounds will do well to keep this in mind.

COLLECTION OF MATERIAL.

About 1 bushel each of sand, such as is used in plastering, sandy loam soil, and clay should be collected. Similarly collect about 3 quarts of leaf mould (well-rotted leaves). Also collect about 4 quarts of soil and subsoil from the same spot. All these should be put in the basement, where they will become air-dry for future class use. It is also desirable to have several bushels of good rich soil for use in growing house plants. Unless it is very rich, about one-fourth stable manure should be mixed with it.

Collect samples of the common diseases and insects for class study. Any of the following diseases or others that occur in the neighborhood; Potato scab, wheat rust, oat smut, brown rot of peaches and plums, black knot, apple canker, corn smut.

Fill two 1-quart jars with pure rain water for use in No. 22, unless you can distill water.

The following samples of fertilizers for exercise may be secured from a local dealer, or students may be able to bring them in, or

they may be secured from the manufacturers. Secure the guaranty analysis and price of each sample. Get about 1 pint each of nitrate of soda or other form of nitrogen, muriate of potash or other form of potash, acid phosphate or other form of phosphoric acid, and at least two samples of complete fertilizers.

NOTEBOOKS.

Each student should keep a notebook, in which all field trips, demonstrations and laboratory work should be written up, giving date, subject of the exercise, materials used, full description of how the work was done, drawings, all data secured, solution of problems, answers to questions that follow the demonstration and laboratory work or to similar questions prepared by the teacher. This should all be given in complete form in good English, not in detached sentences. This really amounts to a discussion or essay on the subject in which drawings, problems, and answers to questions are included.

Many of the demonstrations are of such a nature that they may be assigned to some student in the class, who will take entire charge of the preparation and management of the experiment. This may not very greatly reduce the work for the teacher, but it will be of much value to the students. The notebook discussion of demonstrations should state who did the work.

TIME REQUIRED.

The work here outlined is expected to be sufficient for one year. It can readily be adapted to half this amount of time by omitting exercises. It is desirable that there be three recitations a week and two double periods for laboratory work, field work, and demonstrations. When a field lesson is given, it is desirable that it be the last work of the day, so that it need not be finished at any scheduled time. The demonstration work may often be given in recitation periods. The figure in parentheses following the number of the exercise indicates the relative time that it is thought desirable to devote to the subject. More than this number of periods can be given to each topic and still complete the work in a year. This will give an opportunity to devote more time to those lessons that are of particular interest in the community. By securing the bulletins from the State experiment station, a study may be made of the agriculture of the State.

LATIN.

It is to be carefully noted that a period of nine months should be required to prepare for reading Caesar. In high schools with terms of seven or eight months it is suggested that an additional month or two of the second year be taken to complete this preparation. This will give five or six months for Caesar. During this time, if the preparatory work has been well done, pupils should read two or three books. It is not meant, however, to sacrifice quality for quantity. High schools maintaining a three years' course should omit Virgil entirely.

The following is a brief summary of the things to do and the things to avoid in teaching Latin; it is taken from the report of the Committee of Ten on secondary school studies.

The teacher of elementary Latin need not concern himself too much with the remote ends of the study. To him the question should be: What knowledge is of prime importance, as the foundation for subsequent work? Stated generally, it may be said that the work of the first period should be (1) learning to pronounce accurately and to read fluently and intelligently the Latin text of what has been studied; (2) the mastery of inflection, so that number, case, person, mode, tense, etc., can be instantly recognized and conversely, can be formed without much hesitation by the student himself; (3) the acquisition of a working vocabulary of from one to two thousand words; (4) the mastery of the order of the Latin sentence; (5) the mastery of the simpler principles of syntax regarded as a means of expression; (6) learning how to understand simple narrative in Latin; (7) learning how to translate such narrative into true English. In necessary connection with the pursuit of these aims, a good deal of training of the ear should be employed, through listening to the reading or speaking of the teacher; and, in addition, a certain amount of practice in turning English into Latin will be necessary, as an indispensable instrument for fixing forms in the memory and establishing a feeling for their syntactical powers. On the other hand, the things to be avoided are (1) a dispersion of effort in consequence of the attempt to include too many parts of the study in the first stage; (2) an undue prominence of rules, and the treatment of syntax as an end in itself, rather than as an auxiliary to the penetration of the sense; and (3) the use of "translation English."

COURSE OF STUDY.

First Year.

Beginner's Latin book completed.

25 to 30 pages of easy reading from Fabulae Faciles or Viri Romae.

Second Year.

Standard Latin grammar.

Caesar's Gallic War, 4 books.

Latin composition based on the text.

Vocabulary, syntax, movements of campaigns and narrative themes on certain groups of chapters.

Third Year.

Standard Latin grammar.

Cicero, 4 orations against Catiline.

Manilian Law oration.

Archias oration.

Latin composition based on the text.

Vocabulary, syntax, written translations, Homeric traditions, arguments, theme writing and study of author's style.

Fourth Year.

Standard Latin grammar.

Virgil's Aeneid 6 books.

Vocabulary, syntax, written translations, Homeric traditions, Greek mythology, Roman religion, and the geography of the Mediterranean.

Scansion and practice in reading hexameter verse.

Equipment for Teaching Latin.

Kiepert's Ancient History maps.

Kiepert's or Sanborn's classical atlas.

Galey, Classic Myths in English Literature, Ginn & Co.

Gow, J., A Companion to School Classics, The Macmillan Co.

Johnston, H. W., The Private Life of the Romans, Scott, Foresman and Co.

Becker, W. A., Gallus, or Roman Scenes of the Times of Augustus, Longmans, Green and Co.

Brooks, Edward, Story of the Aeneid.

Wilkins, Primer of Roman Literature, The Macmillan Co.

Froude, Caesar, A Sketch, Scribner's Sons.

Forsythe, Cicero, Scribner's Sons.

Sellar, Virgil, G. P. Putman Sons.

Peck, The Roman Pronunciation of Latin, Henry Holt and Co.

Report of the Committee of Ten, American Book Co.

GERMAN.

The course in German covers four years. In schools in which Latin is not required, German should be pursued for the entire high school course. No foreign language should be studied for a period shorter than two years; neither should two languages be begun at the same time. In a third grade high school it is recommended that pupils pursue but one foreign language. Teachers are urged to guard against selecting reading texts that are too long and difficult.

The following suggestions are taken from the report of the Committee of Twelve of the Modern Language Association of America. Inasmuch as only a very small part of this report can be reprinted here, every teacher of German or French is urged to secure a copy.

The Elementary Course in German.

A. The aim of the instruction.

At the end of the elementary course in German the pupils should be able to read at sight, and to translate, if called upon, by way of proving his ability to read, a passage of very easy dialogue or narrative prose, help being given upon unusual words and constructions. to put into German short English sentences taken from the language of every-day life or based upon the text given for translation, and to answer questions upon the rudiments of the grammar as defined below.

B. The work to be done.

During the first year the work should comprise: (1) careful drill upon pronunciation; (2) the memorizing and frequent repetition of easy colloquial sentences; (3) drill upon the rudiments of grammar, that is, upon the inflection of the articles, of such nouns as belong to the language of every day life, of adjective pronouns, weak verbs, and the more usual strong verbs, also upon the use of the more common prepositions, the simpler uses of the modal auxiliaries, and the elementary rules of syntax and word order; (4) abundant easy exercises designed not only to fix in mind the forms and principles of grammar, but also to cultivate readiness in the reproduction of natural forms of expression; (5) the reading of from 75 to 100 pages of graduated texts from a reader, with constant practice in translating into German easy variations upon sentences selected from the reading lesson, the teacher giving the English and in the reproduction from memory of sentences previously read.

Second Year.

During the second year the work should comprise: (1) the reading from 150 to 200 pages of literature in the form of easy stories and plays; (2) accompanying practice, as before, in the translation into German of easy variations upon the matter read, and also in the offhand reproduction, sometimes orally and sometimes in writing, of the substance of short and easy selected passages; (3) continued drill upon the rudiments of grammar, directed to the ends of enabling the pupil, first, to use his knowledge with facility in the formation of sentences, and, secondly, to state his knowledge correctly in the technical language of grammar.

Third Year.

The work should comprise, in addition to the elementary course, the reading of about 400 pages of moderately difficult prose and poetry, with constant practice in giving, sometimes orally and sometimes in writing, paraphrases, abstracts or reproductions from memory of selected portions of the matter read; also grammatical drill upon the less usual strong verbs, the use of articles, cases, auxiliaries of all kinds, tenses and modes (with special reference to the infinitive and subjunctive), and likewise upon word order and word formation.

Fourth Year.

The work of the advanced course (last year) should comprise the reading of about 500 pages of good literature in prose and poetry, reference reading upon the lives and works of the great writers studied, the writing in German of numerous short themes upon assigned subjects, independent translation of English into German.

COURSE OF STUDY.

First Year.

Beginner's German book. Readers suitable for this year:

Anderson's Märchen, Leander's Träumereien, and Kleine Geschichten, Meissner's Aus meiner Welt.

For memorizing: Heidenröslein, Vergissmeinnicht, Wanderers Nachtlied, Erinnerung.

Second Year.

German grammar.

Readers: Anderson's Bilderbuch ohne Bilder and Träumereien, Gerstacker's Germelshausen, Storm's Immensee, Hillern's Höher als die Kirche, Heyse's L'Arrabbiata or Anfang und Ende.

For memorizing: Die Lorelei, Der gute Kamerad, Wacht am Rhine.

Third Year.

Standard German grammar. Readers:

Freytag's Karl der Grosse, Goethe's Hermann und Dorothea, Moser's Der Bibliothekar, Schiller's Der Neffe als Onkle, Die Jungfrau von Orleans or Wilhelm Tell.

Lessing's Minna von Barnhelm, Hoffmann's Historische Erzälungen.

Fourth Year.

Standard German grammar. Readers:

Freytag's Soll und Haben.

Hauff's Lichtenstein.

Schiller's Maria Stuart.

Goethe's Dichtung und Wahrheit.

Lessing's Emila Galloti.

Fulda's Der Talisman.

Books for teachers:

Report of the Committee of Twelve, D. C. Heath and Co.

Report of the Committee of Ten, American Book Co.

Methods of Teaching Modern Languages, D. C. Heath and Co.

Bagster-Collins, The Teaching of German in Secondary Schools, Macmillan Co.

Hosmer's, A Short History of German Literature, St. Louis, G. J. Jones and Co.

FRENCH.

The course in French covers a period of two years. In case any high school desires this study pursued for a longer time, the report of the Committee of Twelve will help such in the selection of the material. In the course outlined, French is begun in the third year of the high school.

The following suggestions on the amount of work to be done are taken from the report of the Committee of Twelve:

The Elementary Course in French.

During the first year the work should comprise: (1) careful drill in pronunciation; (2) the rudiments of grammar, including the inflection of the regular and the more common irregular verbs, the plural of nouns, the inflection of adjectives, participles and pronouns; the use of personal pronouns, common adverbs, prepositions, and conjunctions; the order of words in the sentence, and the elementary rules of syntax; (3) abundant easy exercises, designed not only to fix in the memory the forms and principles of grammar, but also to cultivate readiness in the production of natural forms of expression; (4) the reading of from 100 to 175 duodecimo pages of graduated texts, with constant practice in translating into French easy variations of the sentences read (the teacher giving the English), and in reproducing from memory sentences previously read; (5) writing French from dictation.

During the second year the work should comprise: (1) the reading of from 250 to 400 pages of easy modern prose in the form of stories, plays or historical, or biographical sketches: (2) constant practice, as in the previous year, in translating into French easy variations upon the texts read; (3) frequent abstracts, sometimes oral and sometimes written, of portions of the text already read; (4) writing French from dictation; (5) continued drill upon the rudiments of grammar, with constant application in the construction of sentences; (6) mastery of the forms and use of pronouns, pronominal adjectives, of all but the rare irregular verb forms, and of the simpler uses of the conditional and subjunctive.

Course of Study.

Third year in high school.

French grammar, such as, Fraser and Squair. French readers:
Aldrich and Foster's French Reader.
Super's Preparatory French Reader.
Bruno's Le tour de la France.
Erchman-Chatrian's Le conscrit de 1813.

For memorizing:

Au clair de la lune.
Le corbeau et la renard.
La cigale et la fourmi.
Historical anecdotes.

Fourth Year in High School.

French grammar, such as, Fraser and Squair.

Readers:

Halevy's L'Abbé Constantin.

Labiche and Martin's Le voyage de M. Perrichon.

Devigny's Le cachet rouge.

About's Le roi des montagnes.

Focin's Le pays de France.

For memorizing:

Le vase brisé, Le rat de ville, La feuille, Extaze, Anecdotes.

TYPICAL PROGRAM OF STUDIES.

First Year.

Required.	Electives.	One
English, 5	Latin, 5	to be elected.
History, 3	German, 5	
Algebra, 5		
Physical Geography, 4		
Civics, 2		
Drawing, 1		

Second Year.

Required.	Electives.	One
English, 5	Latin, 5	to be elected.
History, 3	German, 5	
Algebra, 5		
Botany or Zoology, 5		
Drawing, 2		

Third Year.

Required.	Electives.	Three
English, 5	Latin, 5	to be elected.
History, 3	German, 5	
Drawing, 2	French, 5	
	Geometry (plane), 5	
	Physics, 5	

Fourth Year.

Required.	Electives.	Three
English, 5	Latin, 5	to be elected.
History, 3	German, 5	
Drawing, 2	French, 5	
	Chemistry, 5	
	Solid Geometry, 5	

The figures indicate the number of recitation periods per week. Music should not be excluded from the daily program.

Length of periods should not be less than thirty minutes. Forty minute periods are urged when possible.

Pupils should not have more than five nor less than four full periods daily.

All pupils should take either physics or chemistry. Physical training should be a part of each day's program.

It should never be forgotten that the program of study is made for the benefit of the pupil and that the pupil does not exist for the sake of the course of study. Pupils who are anxious to learn should not be eliminated from the school because they lack taste and talent for Latin or mathematics or science.

REFERENCE LIBRARY FOR SMALL HIGH SCHOOLS.

The following books have been selected after much observation and inquiry. The lists include reference works on both general and special topics. They are by no means exhaustive, but, we hope, will be helpful to teachers and boards of directors in making desirable purchases. It is understood, also, that several up-to-date texts in each subject taught are accessible to pupils. Those with the stars should be selected first and the others added as the funds allow. The prices of the books have been quoted by The Baker and Taylor Co., 33-37 East Seventeenth St., New York City, from whom any number may be selected and purchased at the prices quoted.

General works of reference.

*New International Encyclopedia, Dodd, Mead & Co., N. Y.

*Webster. International Dictionary, $9.25.

*Bliss. Encyclopedia of Social Reforms, $5.63.

*Deems. Holydays and Holidays, $3.33.

*Walsh. Curiosities of Popular Customs, $2.10.

*Crabb. Synonyms, 75 cents.

*Lippencott. Dictionary of Biography and Mythology, $7.20.

*Champlin. Young Folks' Cyclopedia of Persons and Places, $2.00.

*Champlin. Common Things, $2.00.

*Rogent. Thesaurus, 90 cents.

*French. The Study of Words, 88 cents.

*Rand and McNally. Atlas (Imperial), $1.00.

*World Almanac, 40 cents.

*Fry. Soubriquet and Nickname, $1.34.

Literature.

*Granger. Index to Poetry and Recitation, $5.00.

*Brewer. Reader's Hand Book, $1.20.

*Brewer. Dictionary of Phrase and Fable, 90 cents.
*Wheeler. Who Wrote It? $1.20.
*Wheeler. Who's Who in America, $3.00.
*Bartlett. Familiar Quotations, $1.80.
*Matson. References for Literary Workers, $1.34.
*Ringwalt. Briefs on Public Questions, 90 cents.
*Brookings. Briefs for Debate, 88 cents.
*Abbott. Shakespearean Grammar, $1.31.
Stedman and Hutchingson. Library of American Literature (11 vols.), $25.00.

History and Civil Government.

*Green. Short History of the English People, $1.05.
*Committee of Seven. Study of History in Schools, 44 cents.
*Fiske. Critical Period in American History, $1.33.
*Channing and Hart. Guide to American History, $1.75.
*Bulfinch. Age of Fable, 30 cents.
*Bulfinch. Age of Chivalry, 30 cents.
*Larned. History for Ready Reference, $25.00.
*Harper. Encyclopedia of American History, $25.00.
*Bullock. Introduction to the Study of Economics, $1.12.
*Cheyney. Industrial and Social History of England, $1.23.
*Bogart. Economic History of The United States, $1.57.
Goodnow. Politics and Administration, $1.13.
Johnston. Government in State and Nation, $1.40.
*Kiepert. Maps for Ancient History, $1.40.

Science and Art.

*Ames and Bliss. Experiments in Physics, $1.58.
*Smith and Hall. Teaching of Chemistry and Physics, $1.25.
*Hertwig. General Principles of Zoology, $1.53.
*MacDougal. Elementary Plant Physiology, $1.00.
*Bailey. Principles of Agriculture, $1.10.
*Wellbourn. Elements of Agriculture (South and West), 66 cents.
*Gifford. Practical Forestry, 90 cents.
*Pinchot. Primer of Forestry (Pt. 2), 30 cents.
*French. Animal Activities, $1.00.
*Ward. Diseases of Plants, $1.40.
*Dana. Minerals and How to Study Them, $1.13.
*Chapman. Hand Book of Birds of Eastern North America, $1.90.
Mill. International Geography, $2.33.
Chamberlain and Salisbury. Geology (3 vols.), $10.50.
*Hamlin. History of Architecture, $1.34.
Statham. Architecture for General Readers, $3.00.
*Van Dyke. History of Painting, $1.00.
*Marquand. History of Sculpture, $1.00.

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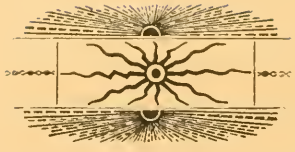

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